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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicant:	**CRAIG T. COMPTON, et al**	)
		)
Serial No.	**09/826,638**	)
		) **FLEXOGRAPHIC PRINTING**
Filed:	**April 5, 2001**	) **PRESS WITH INTEGRAL DRYER**

Commissioner of Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Applicants submit herewith Appellants' Brief. Also enclosed is a check in the amount of $330.00 for the fee for the appeal brief. If any additional fee is required, please charge the cost thereof to our Deposit Account No. 07-2069.

Respectfully submitted,

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Dated: June 21, 2004

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

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Applicant: CRAIG T. COMPTON, et al)
)
Serial No. 09/826,638)
) FLEXOGRAPHIC PRINTING
Filed: April 5, 2001) PRESS WITH INTEGRAL DRYER

Commissioner of Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

APPELLANTS' BRIEF

Applicants-Appellants submit the following Appellants' Brief in support of the appeal from the final rejection of claims 1 and 3-12.

1. Real Party In Interest

The real party in interest is the applicant's assignee, Paper Converting Machine Company.

2. Related Appeals and Interferences

There are no other appeals or interferences known to the appellants, the appellants' legal representative, or assignee which will directly affect of be directly affected by or have a bearing on the Board's decision in the pending appeal.

3. Status of Claims

The pending claims are claims 1 and 3-12. Claim 2 has been cancelled. The claims appealed are claims 1 and 3-12.

4. Status of Amendments

A Reply without an amendment was filed subsequent to the final rejection. The Reply included a translation of Paarmann German Patent DE 39 39 368 A1.

5. Summary of Invention

A conventional flexographic printing press includes a central impression (CI) cylinder or drum, a plurality of print stations positioned around the central impression cylinder, and a dryer system used to dry solvent-based or water-based inks. On modern presses, the ink drying and/or curing process causes the greatest amount of damage to the web which wraps the CI cylinder and which is printed by the print stations. Dryers play a vital role in the printing process. The dryer system on a press is used to extract the ink carrier, either solvent or water, from the ink that is printed on the web.

"Between color" dryers are located on the CI cylinder between each color station. The purpose of the between color dryers is to dry the ink sufficiently so that another layer of ink can be printed on top of the previous layer. Once the last color is printed on the web, the web leaves the CI cylinder and enters a dryer section or tunnel dryer, which evaporates the remaining ink carrier from the printed web.

The problem with tunnel dryers is that, once the ink

carrier has been removed, the heat of the dryer is absorbed into the web. If too much heat is absorbed into the web, the web temperature will exceed the thermal yield point and start distorting. Extensible webs characteristically have low thermal yield temperatures. Also, as a general rule, the thinner the web, the lower the yield temperature. These factors make it more difficult to design and use a tunnel dryer in current flexographic presses.

The invention provides an economical printing press which allows the use of thin gauge, highly elastic films in a flexographic printing process. This is achieved by drying the printed ink on the web before the web is removed from the CI cylinder. By maintaining the web on the CI cylinder throughout the entire drying process, the web will not be susceptible to the disturbances seen in present flexographic presses.

Referring to the drawing, Figure 2 is a side elevational view of a flexographic press designed in accordance with the invention. A web W is unwound from an unwind 41 and travels over idler rolls 44 and nip roll 46 to a CI cylinder 45. (page 5, lines 17-26)

Color decks or printing decks 48 through 55 are positioned around the CI cylinder. Each deck contains an anilox cylinder 56 and a plate cylinder 57 for applying ink to the web W as it rotates with the CI cylinder. Between color dryers 58 through 65 are located between adjacent color stations, and a "between color" dryer 66 is located after the last or downstream

color deck 55. (page 6, line 18 through page 7, line 5)

Prior to the web leaving the CI cylinder, the web passes under two enhanced dryer modules 67 and 68. The dryers 67 and 68 are advantageously formed in accordance with U.S. Patent No. 6,176,184. Each module contains six nozzle plenums, or the equivalent of three "between color" dryer modules, and three heaters, one for each pair of plenums. Each pair of nozzle plenums is heated by its own heat source, which is independently controlled. The last two nozzle plenums on the downstream dryer 68 are advantageously not heated so that the nozzles impinge cold air on the web rather than heated air. The cold air cools the web to insure web stability as it exits the press section. (page 7, line 20 to page 8, line 4)

All of the drying is accomplished while the web W is still riding on the surface of the CI cylinder. By drying the web on the CI cylinder, the invention's primary goal of maintaining web stability is satisfied. (page 8, lines 10-14)

Figure 3 illustrates one specific embodiment of the dryer modules 67 and 68. Three pairs of nozzle plenums 71a and 71b, 72a and 72b, and 73a and 73b are supplied with heated air by air plenums 74, 75, and 76, respectively. The plenums are enclosed within an outer wall 77 which confines the solvent-laden air that is exhausted from the web. Exhaust port 78 exhausts air from the dryer module. (page 8, lines 18-24)

As the web is removed from the CI cylinder, the web passes to idler rolls 85 and 86. The first idler roll 85 defines

the downstream exit point between the web and the CI cylinder. The idler rolls can be either standard rolls or air turn bars or modules. Air turn modules are well known in the art and are used when additional web cooling is necessary to maintain print quality or when special film is used that requires unique downstream drawing requirements. The web travel downstream from the idler rolls 85 and 86 over additional idler rolls to the rewind section 43. (page 9, lines 6-17)

Another striking difference between the prior art and the invention is that the web path is oriented toward the bottom of the press. (page 6, lines 10-12) As illustrated in Figure 2, the nip roll 46 forms the upstream entry point for the web as it advances to the CI cylinder, and the idler roll 85 forms the downstream exit point for the web. Both the entry and exit points are at the bottom of the press, and the length of the web path is minimized. Only twenty-four idler rolls are needed to support the web path of Figure 2, which is about half of the number of idler rolls used by the prior art, and the web length is reduced by about 40%. (page 9, line 22 to page 10, line 2). The design therefore allows highly extensible webs to be run at low tensions. (page 10, lines 2-4)

6. Issues

Whether the Examiner's final rejection of claims 1, 9, 11 and 12 under 35 U.S.C. §103(a) as being unpatentable over George in view of Paarmann is correct.

Whether the Examiner's final rejection of claims 3 and

4 under 35 U.S.C. §103(a) as being unpatentable over George in view of Paarmann and further in view of Hauer is correct.

Whether the Examiner's final rejection of claims 5-8 and 10 under 35 U.S.C. §103(a) as being unpatentable over George in view of Paarmann and further in view of Mudry is correct.

7. Grouping of Claims

The claims of the group of claims 1, 9, 11, and 12 do not stand or fall together.

The claims of the group of claims 3 and 4 do not stand or fall together.

The claims of the group of claims 5-8 and 10 do not stand or fall together.

8. Argument

A. Claims 1, 9, 11, and 12

The Examiner rejected claims 1, 9, 11, and 12 under 35 U.S.C. §103(a) as being unpatentable over George in view of Paarmann.

Claim 1 specifically describes a flexographic printing press for printing a web with a solvent based or water based ink, at least one between color dryer positioned between each pair of adjacent printing decks, and a downstream dryer positioned between the downstream printing deck and the downstream exit point from the central impression cylinder. The last clause of claim 1 states that no dryer is located between the exit point from the central impression cylinder and the rewind apparatus.

No prior art flexographic press has ever been constructed in the manner described by claim 1. Specifically, no flexographic printing press has included between color dryers and a downstream dryer positioned between the downstream printing deck and the downstream exit point from the central impression cylinder with no dryer being located between the exit point from the central impression cylinder and the rewind apparatus.

The Examiner rejected claim 1 as unpatentable over George in view of Paarmann. The Examiner selected two references, each of which is directed to a different problem, and neither of which is directed to the problem solved by the applicants, and combined the two references without any suggestion or motivation in the references to make such a

combination.

George is the primary reference. However, George is not concerned about drying and does not disclose the use of dryers. George simply describes a removable print station which is mounted between the central impression cylinder and the rewinder. Just because George does not specifically address drying does not mean that George teaches that the use of a tunnel dryer is not necessary. Indeed, the invention described by George is not even limited to flexographic presses with a CI cylinder as stated in column 2, lines 31-37 of George.

The invention of George relates to a drop-in print station for a press, and the specification and drawings of George provide a written description of that invention which is sufficient to enable a person skilled in the art to make and use the invention. That is all that the law requires. George is not required to disclose features which are unrelated to the claimed invention and which are not required for an enabling disclosure. However, such a limited description should not be taken as a disclosure or teaching that no dryers are used between the print stations and that no tunnel dryer is used after the last print station.

Attached hereto is an excerpt from "Flexography Principles and Practices," which was attached to the Reply filed March 22, 2004. As the attached excerpt demonstrates, conventional practice in flexography is to include both between color dryers and a tunnel dryer. A person of ordinary skill in

the art who reads George would assume that conventional dryers are used because the ink must be dried somehow.

The Examiner uses George as a disclosure of a press which omits a tunnel dryer. However, simply because George does not disclose a tunnel dryer does not mean that George teaches or suggests the omission of a tunnel dryer. Such a teaching requires more in the nature of a specific disclosure regarding that omission than a simple description of an invention which is not concerned at all about drying and which describes only the invention which is claimed by the patent.

Likewise, Paarmann is concerned only with a specific type of between color dryer, and that is what is described in Paarmann. An English translation of Paarmann is attached hereto, and the translation was submitted with the Reply which was filed on March 22, 2004.

Paarmann is not concerned with the structure of the tunnel dryer and does not even describe or illustrate the right side of the press or the portion of the press between the central impression cylinder and the rewind apparatus. Paarmann's drawings illustrate only three print stations and three between color dryers on the left side of the press. The limited disclosure of Paarmann cannot be interpreted as a specific disclosure or teaching that the flexographic press described in Paarmann omits a tunnel dryer between the exit point from the central impression cylinder and the rewind apparatus. The use of a tunnel dryer is conventional and would be assumed by a person

of ordinary skill.

Taken to its logical conclusion, the Examiner's position would be that Paarmann teaches a flexographic press without any rewinder or other means for supplying the web to the central impression cylinder, without any print stations located on the right side of the central impression cylinder, and without any means for rewinding the web because none of that structure is described or illustrated in Paarmann. Clearly, a person of ordinary skill in the flexographic printing art would understand that the portion of the printing press which is not described or illustrated in Paarmann is conventional, including the use of a conventional tunnel dryer between the exit point from the central impression cylinder and the rewind apparatus.

In order to combine Paarmann with George there must be some motivation or suggestion for making the combination. Since George is concerned with a drop-in print station and is not concerned at all about dryers, there is no suggestion in George to use anything other than conventional flexographic drying technology, i.e., between color dryers and a tunnel dryer. Paarmann is concerned only about a particular type of between color dryer and does not even describe the remainder of the flexographic press. There is no motivation, teaching, or suggestion in Paarmann of eliminating the conventional tunnel dryer between the central impression cylinder and the rewind apparatus. There is therefore no suggestion or motivation in either George, Paarmann, or the prior art in general of combining

the limited disclosures of George and Paarmann to arrive at the flexographic press which is described in claim 1.

The Examiner states that Paarmann teaches a between color dryer between the downstream printing deck and a downstream exit point. However, all that Paarmann discloses is a between color dryer at about the 7 o'clock position on the central impression cylinder. Persons of ordinary skill in the art understand that additional print stations are located on the right side of the central impression cylinder, and the between color dryer at the 7 o'clock position is the between color dryer for the non-illustrated print station which would be located at about the 5 o'clock position. Paarmann does not show the exit point of the web from the central impression cylinder or the downstream printing deck which is adjacent the exit point. Paarmann therefore does not disclose a between color dryer between the downstream printing deck and the downstream exit point.

Claim 9 is dependent on claim 1 and states that each of the between color dryers and the downstream dryer includes a heat source for heating air which is directed by the dryer to a web which is supported by the central impression cylinder. George does not describe any type of dryer, and Paarmann does not describe a downstream dryer positioned between the downstream printing deck and the downstream exit point. Indeed, Paarmann does not describe or illustrate the second half of the central impression cylinder and therefore does not disclose an exit

point.

Claim 11 is dependent on claim 1 and states that the press includes a top and a bottom and that the upstream entry point to the central impression cylinder is adjacent the bottom of the press and the downstream exit point from the central impression cylinder is adjacent the bottom of the press.

The Examiner acknowledged that George does not teach that the upstream entry point to the central impression cylinder is adjacent the bottom of the press and the downstream exit point from the central impression cylinder is adjacent the bottom of the press. However, the Examiner stated that it would be obvious to one having ordinary skill in the art to position the exit points in any configuration since such a modification appears to be nothing more than the mere shifting of the location of parts that does not substantially alter the functioning of the device and that one having ordinary skill in the art would recognize that it would be obvious to position the upstream entry point to the central impression cylinder and the downstream exit point from the central impression cylinder adjacent to the bottom of the press in order to accommodate the design of the facility in which the press is installed and the location of auxiliary equipment interacting with the impression cylinder.

The Examiner's conclusions with respect to claim 11 are unsupported by any of the references. Indeed, conventional flexographic presses have top-oriented web infeed and outfeed paths precisely because of the need to route the web through a

tunnel dryer as illustrated, for example, in the references of Lovin and Mudry.

The web path described in claim 11 results in a much shorter web path between the unwind apparatus and the central impression cylinder and between the central impression cylinder and the rewind apparatus with a consequent reduction in the number of idler rollers over which the web must pass. As explained on page 3 of the application, a significant cause of web deformation is the tension imparted on the web as the web travels through the machine. The web is supported through the tunnel dryer and between machine sections by idler rolls. In most applications, the web is used to rotate the idler rolls. The web path therefore plays a significant role in the amount tension required in the system. The longer the web path, the greater the amount of idler roll friction the web needs to overcome or drive, which in turn is proportional to the amount of tension imparted on the web. The extensible films which are particularly suited for use in the invention can withstand only minimal tension before permanent distortion occurs. As stated on pages 9 and 10 of the application, the inventive web path reduces the number of idler rolls to about half of the number of the prior art, and the web length is reduced by about 40%. The invention therefore permits highly extensible webs to be run at low tensions.

Clearly, if the prior art were able to devise a way for minimizing web path length and web tension by having a bottom

oriented entry point to the central impression cylinder and a bottom oriented exit point from the central impression cylinder, there would be a clear disclosure of such entry and exit points in the prior art. The Examiner has not found any such prior art.

Claim 12 is dependent on claim 11 and adds the description of a nip roll mounted adjacent the upstream exit [sic; should be "entry"] point to the central impression cylinder and a roll mounted adjacent the downstream exit point from the central impression cylinder. The Examiner stated that George shows a nip roll 29 mounted adjacent the upstream exit point to the central impression cylinder and a roll 44 mounted adjacent the downstream exit point from the central impression cylinder. However, the rolls 29 and 44 of George are located at the top of the press whereas the upstream entry point and downstream exit point of claim 12, and therefore the associated rolls, are adjacent the bottom of the press.

B. Claims 3-4

The Examiner rejected claims 3-4 under 35 U.S.C. §103(a) as unpatentable over George in view of Paarmann and further in view of Hauer. The Examiner stated that it would have been obvious to having one having ordinary skill in the art at the time of the invention to use the air turning bar of Hauer to guide the web of George, as modified by Paarmann, adjacent to the exit point from the central impression cylinder in order to be able to guide the web without contacting the bar to eliminate the

chance of smearing the freshly printed web.

However, there is no motivation or suggestion in any of the references for combining Hauer with George and/or Paarmann. In particular, there is no suggestion or disclosure in any of the references of using an air turning bar adjacent a downstream exit point from a central impression cylinder.

C. Claims 5-8 and 10

The Examiner rejected claims 5-8 and 10 under 35 U.S.C. §103(a) as unpatentable over George in view of Paarmann and further in view of Mudry. The Examiner stated that Mudry teaches a dryer having a plurality of nozzle plenums, a plurality of heat sources, and a separate control means for each of the heat sources and that it would have been obvious to one having ordinary skill in the art at the time of the invention to construct the dryers of George, as modified by Paarmann, using the structure of Mudry in order to more effectively dry the printed web.

Mudry was disclosed by the applicants in the application. Page 7, lines 6-7 states that the between color dryers are advantageously formed in accordance with Mudry. Page 7, lines 15-16 states that the two enhanced dryer modules 67 and 68 are also advantageously formed in accordance with Mudry.

However, Mudry describes the conventional placement of between color dryers and a tunnel dryer. Mudry does not disclose completely drying the web without damaging it while the web is still on the central impression cylinder by totally eliminating

the tunnel dryer.

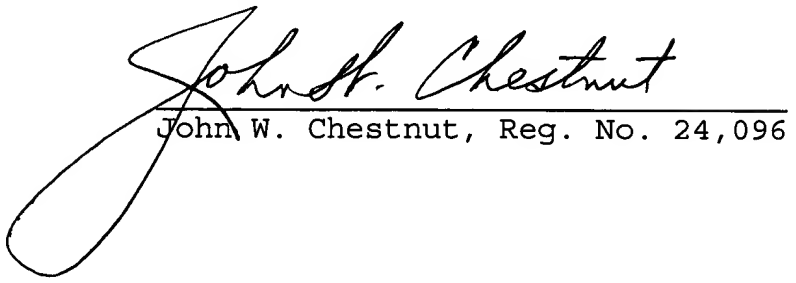
The Examiner stated that, with respect to claims 6-7 and 10, it should be noted that the addition of a second dryer is a mere duplication of parts not sufficient to patentably distinguish the claimed invention from the prior art since no new of unexpected results are apparent. However, the second downstream dryer 68, on a flexographic printing press which has no dryer located between the exit point from the central impression cylinder and the rewind apparatus, insures that the web will be completely dried while it is on the central impression cylinder so that the web remains stable throughout the drying process. Further, as stated in the paragraph bridging pages 7 and 8 of the application, the use of a second downstream dryer 68 allows the last two nozzle plenums to be used for directing cold air on the web rather than heated air. The cold air cools the web and insures web stability as it exits the press section.

The Examiner stated that, with respect to claims 8 and 10, it should be noted that as each heat source has a separate control means, it would be obvious to turn one of these off in order to provide unheated air to a nozzle plenum. However, there is no teaching or suggestion in any of the references of a means for supplying unheated air to a nozzle plenum of a downstream dryer for directing cold air against a web on the central impression cylinder.

9. Conclusion

Appellants respectfully request that the Examiner's final rejection of claims 1 and 3-12 be reversed.

Respectfully submitted,



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Dated: June 21, 2004

APPENDIX

The following claims are involved in this appeal:

1. A flexographic printing press for printing a web with a solvent based or water based ink comprising:

a central impression cylinder having an outside surface adapted to support a web during printing,

an unwind apparatus adapted to unwind a web to be printed on the central impression cylinder,

means for guiding a web between the unwind apparatus and the central impression cylinder and providing an upstream entry point to the central impression cylinder,

a rewind apparatus adapted to rewind a printed web,

means for guiding a web between the central impression cylinder and the rewind apparatus and providing a downstream exit point from the central impression cylinder, the unwind apparatus, central impression cylinder, and rewind apparatus defining a path of web travel from an upstream direction to a downstream direction,

a plurality of printing decks positioned around the outside surface of the central impression cylinder, including an upstream printing deck adjacent said upstream entry point and a downstream printing deck adjacent said downstream exit point,

each of the printing decks including a plate cylinder for applying solvent based or water based ink to a web on the central impression cylinder,

at least one between color dryer positioned between each pair of adjacent printing decks, and

a downstream dryer positioned between the downstream printing deck and the downstream exit point for drying a web on the central impression cylinder before the downstream exit point, no dryer being located between said exit point from the central impression cylinder and said rewind apparatus.

3. The press of claim 1 in which said means for guiding a web between the central impression cylinder and the rewind apparatus includes an air turning bar.

4. The press of claim 3 in which said air turning bar is adjacent said exit point from the central impression cylinder.

5. The press of claim 1 in which said downstream dryer includes a plurality of nozzle plenums, a plurality of heat sources, and separate control means for each of the heat sources.

6. The press of claim 1 including a second downstream dryer positioned between the downstream printing deck and the downstream exit point for drying a web on the central impression cylinder before the downstream exit point.

7. The press of claim 6 in which each of said downstream dryers includes a plurality of nozzles, a plurality of heat sources, and separate control means for controlling each of the heat sources.

8. The press of claim 1 in which the downstream dryer includes a nozzle plenum for directing air against a web supported by the central impression cylinder and means for supplying unheated air to the nozzle plenum whereby cold air is directed by the nozzle plenum against the web.

9. The press of claim 1 in which each of the between

color dryers and the downstream dryer includes a heat source for heating air which is directed by the dryer to a web which is supported by the central impression cylinder.

10. The press of claim 9 including a second downstream dryer positioned between the downstream printing deck and the downstream exit point for drying a web on the central impression cylinder before the downstream exit point, the downstream dryer including a nozzle plenum for directing air against a web supported by the central impression cylinder and means for supplying unheated air to the nozzle plenum whereby cold air is directed by the nozzle plenum against the web.

11. The press of claim 1 in which the press includes a top and a bottom and the upstream entry point to the central impression cylinder is adjacent the bottom of the press and the downstream exit point from the central impression cylinder is adjacent the bottom of the press.

12. The press of claim 11 including a nip roll mounted adjacent the upstream exit point to the central impression cylinder and a roll mounted adjacent the downstream exit point from the central impression cylinder.

FLEXOGRAPHY

PRINCIPLES AND PRACTICES

FOUNDATION OF FLEXOGRAPHIC TECHNICAL ASSOCIATION

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can be restarted and the impression control energized. After this, the anilox roll comes in contact with the plate cylinder and the plate cylinder in contact with the web, and the printing resumes.

Side and Circumferential Register Control

A number of devices are presented to the operator by press manufacturers to adjust side and circumferential registration. Most common is a mechanical apparatus, such as a handwheel which, when connected in a number of ways to the plate cylinder, will cause the plate cylinder to be laterally moved. Circumferential register can also be furnished by a simple handwheel by allowing the plate cylinder and associated gearing to be connected to a helical gear. The male spline clamped to the plate cylinder journal in conjunction with a female spline will allow the plate cylinder gear to slide forward and back on the male spline to affect the circumferential register without affecting the side register of the plate cylinder.

A number of hydraulic or electrical devices can be designed and installed to allow the operator not only convenient access to the register controls but allow a degree of automation. Normal occurrence with automatic deck positioning systems would allow the possibility of automatically centering both side and circumferential register devices which, with properly positioned plates, will provide the operator, upon rack-in and gear mesh, with a properly registered print job very close to acceptable quality without further adjustment.

The motor operated type, whether hydraulic or electric, can be furnished with the capability to be pulsed, that is, upon activation of a pushbutton or switch the units will be programmed to move a certain increment. Incremental movement is a great asset, especially for a high quality process print where fine register capabilities is paramount. By providing the capabilities for pulse registration, the operator has the ability to adjust and fine tune registration from a remote area, such as a web viewer or video monitor. The above capability saves lost motion, which equates directly to higher quality print with less loss.

Dryers

Flexographic presses have integrated drying systems. There are individual dryers after each print station except the last one, which has a much longer dryer. These dryers are known as either between-color or interstation dryers. The dryer after the last print station is called the main tunnel or overhead dryer.

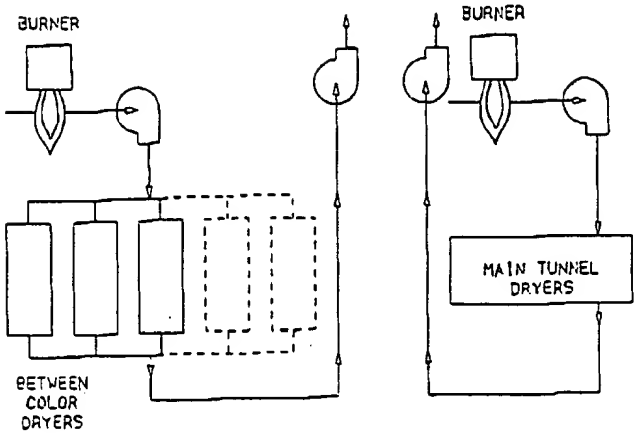


Figure 10-31. Air-flow scheme, example 1.

Interstation dryers remove a sufficient amount of volatiles from the ink so that the next print station may apply another color without altering the previous one. On a four-color stack press there are typically three interstation dryers. A color CI press usually has five. In either a stack press or CI press, there is one main tunnel dryer. The latter removes the volatiles from the last printing station and completes the heat setting of all the inks applied. The main tunnel dryer also removes the final traces of volatiles from products where retained solvents could present problems, i.e., blocking.

The interstation and main tunnel dryers have various air flow schemes, depending on the vintage and manufacture of a press. For example, a press might have one supply fan, one burner and one exhaust fan for the main tunnel dryer and a parallel system for the interstation dryers, with each one sharing one supply fan and one exhaust fan (Figure 10-31). This system gives the press operator the ability to independently control air temperatures to either the interstation dryers or main tunnel.

Other examples of air flow schemes are:

- ☐ One supply fan and one burner ducted to both the interstation dryers and main tunnel dryer, then exhausted through common exhaust fan (Figure 10-32).

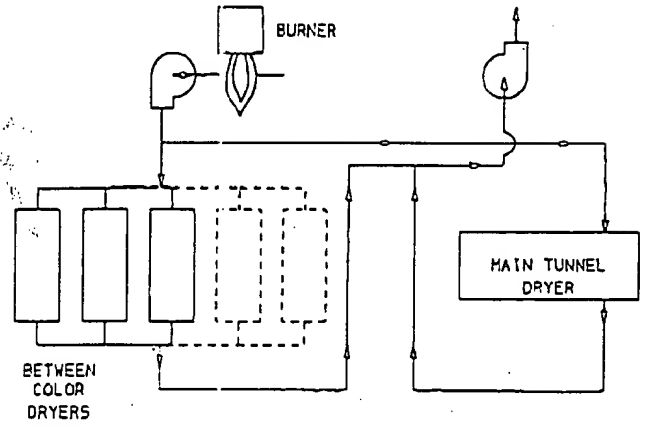
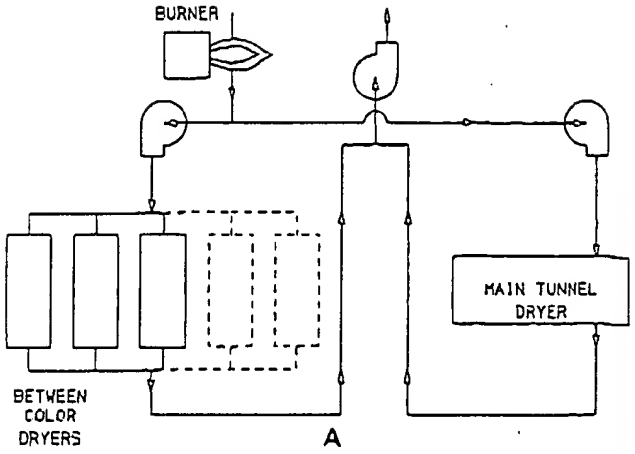


Figure 10-32. Air-flow scheme, example 2.



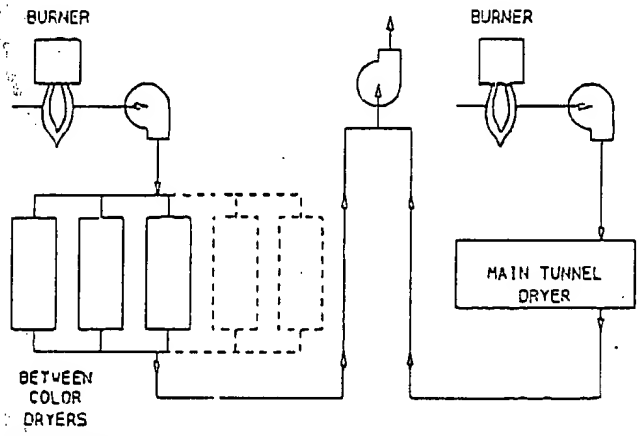


Figure 10-33. Air-flow scheme, example 3.

B

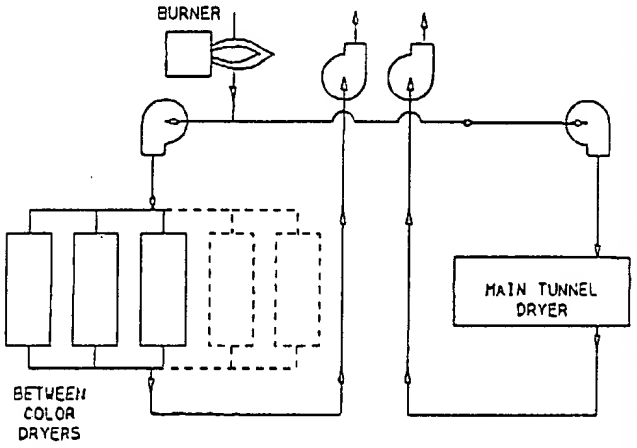


Figure 10-34A,B. Air-flow scheme, example 4.

- ☐ Independent supply fans and burners, but exhausted with a common exhaust fan (Figure 10-33).
- ☐ Independent supply fans with one common burner with exhaust through an independent or common exhaust fan (Figures 10-34A,B and 10-35).

As with any rule, there may be exceptions. Some may exist where the interstation dryer exhaust is also the main tunnel supply or vice versa, as in a cascading air flow system.

Again, flexographic press dryers use hot air to remove the volatile portion of the ink. This air is ducted and directed to the substrate where the substrate, ink solids, and ink volatiles are raised to a temperature that will do the job. With this in mind, the important considerations for any dryer are:

- ☐ Air temperature
- ☐ Air velocity
- ☐ Air volume
- ☐ Time

Air Temperature

The higher the temperature, the quicker drying can occur, but high temperatures can have drawbacks such as possible substrate damage. They also might dry the top surface of the ink, forming a crust which must be broken to vaporize ink under the surface against the substrate. These defects could show up as pock marks or "fisheyes."

Air Velocity and Volume

The greater the velocity and volume of heated air directed to the substrate, the quicker the volatiles can be vaporized. This is because the substrate and

ink reach the ink-vapor temperature. Velocity and volume relate directly to fan horsepower.

Time

Sufficient time with a proper combination of air velocity, air volume and air temperature allows the substrate and ink to get hot enough to vaporize the volatiles. The length of the air dryer versus the linear speed of the substrate determines the length of time.

How It Works

Normally, the supply fan takes air from either the roof or inside the plant past a gas-fired burner and directs this air to the substrate. The heated air is pushed onto the substrate through a series of air nozzles, narrow slots running perpendicular to the substrate travel, across the width of the substrate. After vaporizing the volatiles, the exhaust fan pulls this air from the dryer and sends it to either the atmosphere or a pollution-control device. With this exhaust air, ambient air is pulled into the dryer at the web entrance and exit. This helps keep the dryer under a slight negative pressure that prevents volatile air from escaping into the plant. In all cases, the exhaust volume is greater than the supply volume.

The exhaust air-flow volume from the press dryer is designed according to National Fire Prevention Association (NFPA) guidelines. These state that the ventilation or exhaust rate must be designed and maintained to prevent the vapor concentration in the dryer from exceeding 25% of the lower explosive limit (LEL). This limit is based on ink/solids/solvent concentrations, types of solvents, press speed, substrate width and the number of printing units. All these must be considered to determine the maximum solvent conditions or the most solvent the dryer will have to evaporate. The exhaust or ventilation rate can be reduced with a continuous-vapor concentration indicator and/or controller. With one of these on line, the lower explosive limit won't exceed 50%.

The NFPA says that an estimated rate of ventilation or exhaust can't be less than 10,000 cubic feet (standard as referenced to 70 degrees) per gallon of solvent evaporated in the dryer. This estimated rate makes for a 25% lower explosive limit.

In all cases, when dealing with dryer exhaust rates, consult the press/dryer manufacturer or the proper authority having jurisdiction.

Now that pollution-control equipment is mandated, flexographic press dryer air-flow schemes have been revised to reduce the volume of air to be processed by pollution control devices. The EPA's capture requirements on total emissions must be met, limiting the amount of air that can be exhausted.

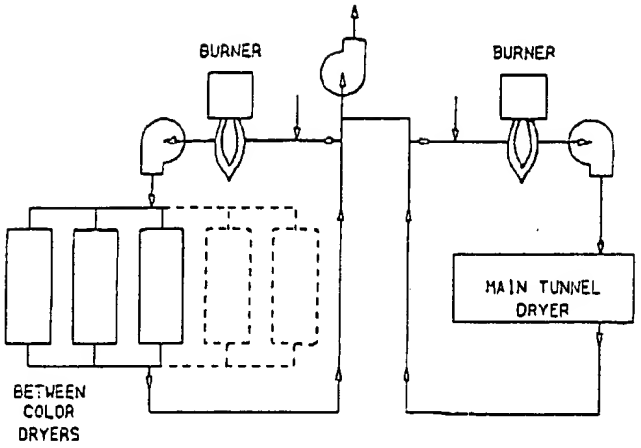


Figure 10-35. Air-flow scheme, example 5.

Most press manufacturers offer a recirculation air-flow scheme that recycles air with volatilized solvents (Figure 10-35). The recirculation principle utilizes a supply fan sized to provide the necessary volume and pressure of hot air to the dryer and to exhaust the majority of that air with volatiles. A smaller exhaust fan removes the infiltration air, products of combustion and any leakage into the dryer. In all cases, this exhaust must meet the guidelines of NFPA for lower explosive limits.

MECHANICAL COMPONENTS

CI Drum

Drum construction can be of double-wall steel or cast iron. In either case the drum will be temperature controlled by a heating/cooling device. As markets advanced in flexography and the product expected from a CI press improved to a high degree of excellence, press manufacturers were compelled to hold more demanding tolerances in reference to the CI drum. Very commonly employed today is the use of digitally controlled heating/cooling elements which guarantee to hold drum temperature within ±1°F. This close tolerance reflects directly to achieving printing excellence being demanded of press manufacturers and converters today. If the press experi-

TRANSLATION

DE 39 39 368 A1

ABSTRACT

The subject color printing system shows a temperature-controlled counter-pressure cylinder (1) having a film web (2) or paper web to be printed running therearound, said cylinder having a plurality of inking assemblies (3) associated therewith each followed in the direction (A) of web movement by ink drying means (7).

Each said drying means includes a drying box (8) extending along the length of the counter-pressure cylinder and having therein blow nozzles connected with blower air supply means and discharge suction ducts connected with blower air return means.

DESCRIPTION

The invention relates to a color printing system or print stand including a temperature-controlled counter-pressure cylinder having running therearound film webs or other materials to be printed, and a plurality of inking assemblies each followed in the direction of film movement by ink drying means, said ink drying means each including a drying box extending along the width (length) of the counter-pressure cylinder and having therein blow nozzles connected with a blower air supply port and suction ducts connected with an air return port.

In color printing systems of this nature, the concentration of heat at the drying stations following the inking stations presents problems in that the said drying stations are not insulated thermally and undesirably emit heat to the outside and to subsequent ink applying stations, which may result in printer mal-

function in operation; the ink applying stations should not be subjected to thermal influence as the heat may solidify the ink to be applied and thus would preclude unobjectionable printing runs.

In the absence of the former heating influence of the various drying temperatures, the effects thereof on the anilox roller, the printing cylinder with the plates thereon and the lateral frame members would be completely eliminated. Also, such absence would result in a more precise initial adjustment if the inking units, which would not require frequent re-adjustment, and in an enhanced print quality.

Outwardly directed thermal radiation causes gases to be released from the inks which are annoying to the operating personnel and damaging the environment.

For these reasons, it is necessary to provide for a safe supply of heat to and shielding thereof at the sites specified; this has never been accomplished conventionally even where sophisticated means and procedures were used.

It is the object of the invention to provide a color printing system constructed as initially set forth of which the ink drying means are thermally insulated from the environment in a simple, cost-saving and safe manner and in which the heated drying air is supplied in a well-aimed manner to the treating site in the shielded area.

In accordance with the invention, this object is attained by the characterizing features of patent claim 1, with the configuration features in the various dependent claims constituting advantageous further developments of the aforesaid solution of the underlying problem.

The invention provides ink drying means including a drying box adapted to outwardly and thermally insulatedly discharge the warm air for drying the ink applied to the film web and to do so in a well-directed as well as simple, cost-saving and safe manner without affecting the external portions of the printing system in any way.

The drying box is provided with/formed of a thermally insulated material and/or equipped with a reflecting mirror having a focus-like configuration, a focus of flexibly selectable degrees or a vacuum body (like a thermos flask, for example). The mirror and the insulating body may be designed to form a focus-like dual-wall vacuum element of a metal or a plastics material so that these thermal insulating and retaining means cause the heat to be concentrated in the drying box and thus within the drying area, whereby the exterior thereof will not be affected by the heated air.

These measures cooperate to dry the printed film web in an optimum manner and without functionally impairing the subsequent inking mechanisms (immersion roller, anilox roller, doctor blade fountain, pressure cylinder and printing plates).

In addition, thermal radiation outwards to the inking mechanisms is prevented so that no gases will be released from the inks in the inking units, whereby work sites will be more environmentally friendly and more pleasant to the operating personnel.

The drawings depict variations of an embodiment example of the invention, which will be explained in detail below.

Fig. 1 schematically shows a printing stand including a counter-pressure cylinder having a film web running therearound, inking units associated therewith and ink drying means associated with the inking units;
Fig. 2 shows a sectional view taken through an ink drying assembly including a drying box as well as blow nozzles and suction ducts therein;
Fig. 3 to Fig. 7 show sectional views taken through wall portions of the drying box with various kinds of thermal insulation;
Fig. 8 shows a sectional view taken through a drying box configured in departure from Fig. 2.

There is generally shown at (1) a temperature-controlled counter-pressure cylinder included in a printing stand or an inking assembly, said cylinder having running therearound a plastic film web (2) or paper web to be printed.

Counter-pressure cylinder (1) has arranged therearound a plurality of inking units (3) each including an ink box with ink supply nips (4), an immersion roller (supply roller) (5) disposed therein and an anilox roller (metering roller) (5a) - or, alternatively, simply an anilox roller and a doctor blade - as well as an exposed print cylinder (6) cooperating with film web (2).

Each inking unit (3) is followed in the direction "A" of film web movement by ink drying means (7) including an ink drying box (8) extending along the length of counter-pressure cylinder (1) and having therein blow nozzles (10) connected with a blower air supply port (9) and a suction channel (12) connected with a vacuum-type air return port (11).

Drying box (8) is formed to be a chamber profiled to expand towards counter-pressure cylinder and having roller-side edges (8a) engaging film web (2) sub-

stantially without leaving a gap therebetween to allow as little air as possible - or no air at all - to escape from drying box (8).

Drying box (8) has therein two air chambers (13, 14) a blower-side one of which (13) is connected with blower air supply port (blower air line connector) (9) and supports blow nozzles (10) extending therefrom towards counter-pressure cylinder (1); the suction-side other one (14) is connected with the vacuum return duct (11) to cooperate with drying box (8) to form the suction side.

Blow nozzles (10) serve to blow hot air having a temperature of approx. 60 deg. to 80 deg. into drying box (8) where a swirling movement is imparted thereto and it is moved against the moving film web (2) in order to dry the ink; thereafter, it flows back laterally over nozzles (10) and is withdrawn through vacuum duct (12).

Counter-pressure cylinder (1) is maintained at a temperature of about 30 deg., which is considered a cooling temperature relative to the hot air used for drying the ink.

In order to utilize the hot air for drying the ink and to not allow it to carry heat from drying box (8) outwardly into the environment and, especially, into the adjacent inking units (3), the inside and outside surfaces (15, 16) of drying box (8) are designed to be thermally insulating relative to each other.

Such thermal insulation of the drying box walls may be configured in a variety of ways, that is:

1. Drying box wall (17), which is metal or the like, has one or several layers of insulation (18) applied to the outside surface thereof (Fig. 3).

2. Drying box wall (17), which is metal or the like, has one or several layers of insulation (18) applied to the inside surface thereof (Fig. 4).
3. Drying box wall (17) has a mirror (reflecting coat) (19) applied to the inside or outside surface thereof (Fig. 5).
4. The drying box wall itself is formed of a single- or multi-layered insulating wall (20) (Fig. 6).
5. The drying box wall itself is formed of a single- or multi-layered insulating wall (20) and a reflector (19) on the inner or outer surface thereof (Fig. 7).
6. Drying box wall (17) has a reflector (19) on one of the inner and outer sides thereof and a single- or multi-layered insulation (18) on the respective other side.
7. Drying box wall (17) is designed to form a hollow wall having a vacuum inside it like the walls of a thermos flask, whereby wall (17) constitutes a dual-wall vacuum element.
8. Drying box (8) has a reflecting mirror in a focus-like arrangement disposed therein, with the focus degrees being flexible or variable.
9. The reflector and the insulating walls of drying box (8) can be made of a metal and/or plastics material to form a dual-wall vacuum element.

The thermal insulation of drying box (8) is provided in its entire inner and/or outer areas, so that drying box (8) thermally surrounds air chambers (13, 14) as well.

The insulating material may be any material having thermally insulating properties, including foamed or fibrous plastics of any kind and composition, glass wool, mineral wool, glass and mineral foam, carbon fiber products, organic products and natural insulating materials such as cotton, hair, felt.

The outer shape of drying box (8) may vary or may be selected to conform with existing space constraints, resp.

PATENT CLAIMS

1. Color printing system including a temperature-controlled counter-pressure cylinder having running thereabout a film web to be printed, as well as a plurality of inking units disposed circumferentially of the counter-pressure cylinder and each followed in the direction of film web movement by ink drying means including a drying box extending along the length of the counter-pressure cylinder and having therein blow nozzles connected with a blower air inlet port and suction channels connected with a blower air return port, **characterized** in that the inside and outside surfaces (15, 16) of drying box (8) are thermally insulated from each other.

2. Color printing system as in claim 1, characterized by drying box (8) having a single- or multi-layered insulation (18) on the outer surface of its wall (17).

3. Color printing system as in claim 1, characterized by drying box (8) having a single- or multi-layered insulation (18) on the inner surface of its wall (17).

4. Color printing system as in claim 1, characterized by drying box (8) having a reflector (19) on the inside or outside surface of its wall (17).

5. Color printing system as in claim 1, characterized by the wall of drying box (8) being formed of a single- or multi-layered insulation (20).

6. Color printing system as in claim 1, characterized by the wall of drying box (8) being formed of a single- or multi-layered insulation (20) and a reflector (19) on the inside or outside surface.

7. Color printing system as in claim 1, characterized by wall (17) of drying box (8) having a reflector (19) on one side thereof and a single- or multi-layered insulation (18) on the other side thereof.

8. Color printing system as in claim 1, characterized by the wall of drying box (8) being formed of a dual-wall vacuum element.

9. Color printing system as in claim 1, characterized by drying box (8) having provided therein a reflecting mirror (21) in a focus-like arrangement.

10. Color printing system as in one or more of claims 1 to 9, characterized by said thermal insulation of drying box (8) being provided on the entirety of its inside and/or outside surfaces.

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